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# Grazing Values on Undisturbed Chaparral Versus Areas Converted to Grass:

*The Tonto Springs Range*

by

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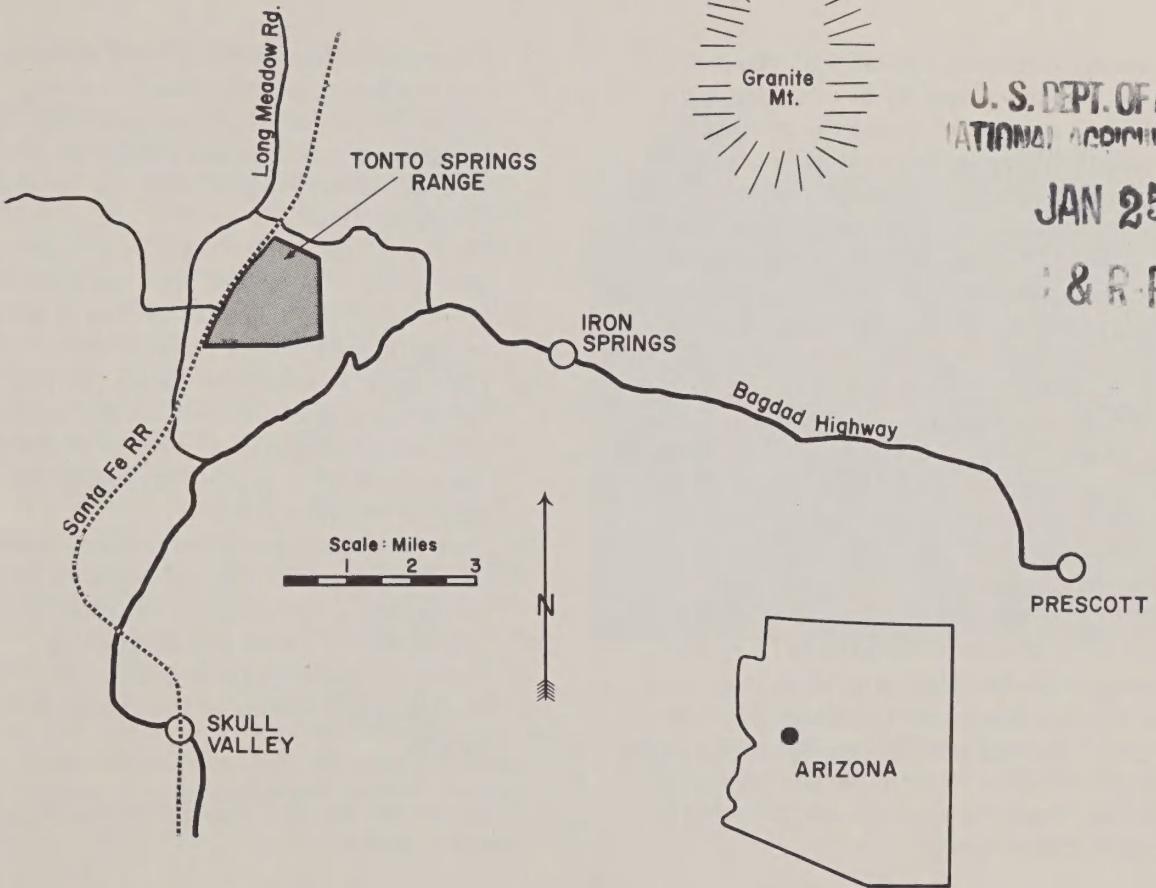


# CORONADO

Floyd W. Pond, a range scientist for the Rocky Mountain Forest and Range Experiment Station, is located at Flagstaff in co-operation with Northern Arizona University. Central headquarters for the Station is maintained at Fort Collins in cooperation with Colorado State University.

TONTO SPRINGS RANGE, part of a cattle grazing allotment on the Prescott National Forest in Arizona, is used as a pilot test to obtain information on comparative grazing values of native chaparral and converted grass. The study is conducted jointly by the Prescott National Forest and the Rocky Mountain Forest and Range Experiment Station of the Forest Service, U. S. Department of Agriculture. Through January 1967, livestock were furnished under permit by Mr. R. L. Iles; since March 1967, Mr. Ed Balmes has furnished the cattle.

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Figure 1.--Location of the Tonto Springs study area.

The Arizona chaparral, an area of about 4 1/2 million acres, has been used by livestock since the late 1800's. The value of chaparral as livestock range, however, has never been carefully assessed. Many stockmen consider brushlands a valuable source of forage and browse, especially for winter grazing and during drought periods when herbaceous forage is sparse. Others believe that replacement of the shrubs by grass would increase the forage resource. Recent studies have shown these lands to be productive. When competing shrubs were removed, more than 1,500 pounds of seeded grass per acre were produced. Also, replacement of shrubs by grass increased water production on certain watersheds.

The grazing values of chaparral range, however, have not been well understood; neither do we know what the grazing values will be after they are converted to grass. To help answer some of these questions, and to provide a better basis for managing chaparral range for cattle grazing, a study was started in 1961 on the Prescott National Forest on an area known as the Tonto Springs Range (fig. 1). The overall objective is to compare grazing values on undisturbed chaparral versus areas converted to grass. Specific objectives are:

1. Compare cattle production from (a) root-plowed and seeded chaparral grazed yearlong, (b) undisturbed chaparral grazed yearlong, and (c) root-plowed and seeded chaparral grazed in summer in combination with native chaparral grazed in winter.
2. Determine season or seasons when cattle make best gains from shrubs, from the grass conversions, and from the combined use of both kinds of plants, and the total gain per animal.
3. Determine if chaparral range that has been converted to grass will continue to produce large amounts of forage if 40 percent of the current year's growth is grazed (a) during the entire year, or (b) in summer only.
4. Determine relative nutrient content, digestibility, utilization and other forage values of the shrubs in the chaparral for cattle, especially shrub live oak<sup>2</sup> which is the most prevalent shrub.
5. Provide a better basis for determining condition and proper utilization of the chaparral as cattle range.

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<sup>2</sup>Common and botanical names of plants mentioned are listed on page 13.

## Climatic and Physical Conditions

Temperatures at Tonto Springs vary from a low of near 0° F. in the winter to a high that rarely exceeds 100° F. in midsummer. Annual precipitation averages approximately 17 inches, with about half falling in winter (October-April) and half in summer (May-September). Winter moisture results from Pacific storms, and may fall as rain or snow, depending on temperature. Snow rarely covers the ground more than 3 days, although unusually heavy snows may cover the ground for 2 or more weeks about once in 10 years. Summer rainfall is from storms that move in from the Gulf of Mexico, generally as thunderstorms of short duration but high intensity.

The range, lying at about 5,000 feet elevation, is located on rolling granitic outwash from the mountain to the east (fig. 2). Soils are from one to several feet deep, and contain some quartzite, basalt, and other debris. These soils have been described and separated into five mapping units (fig. 3), three recent and two alluvium, varying from a relatively shallow upland soil to a deep alluvium.

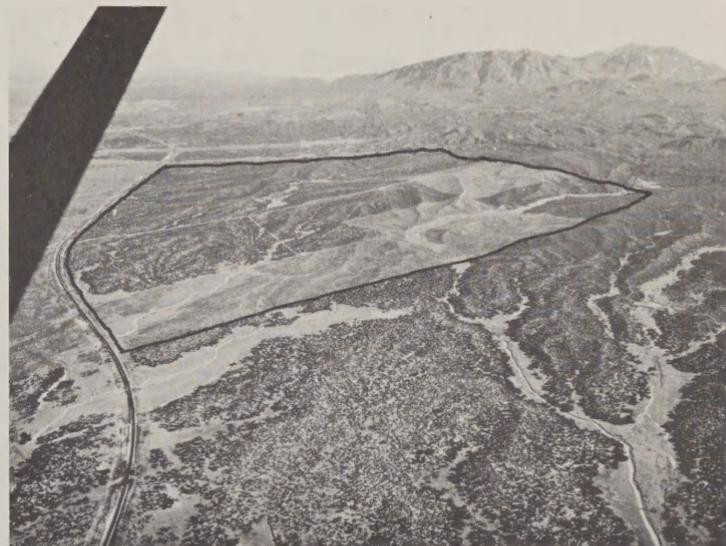
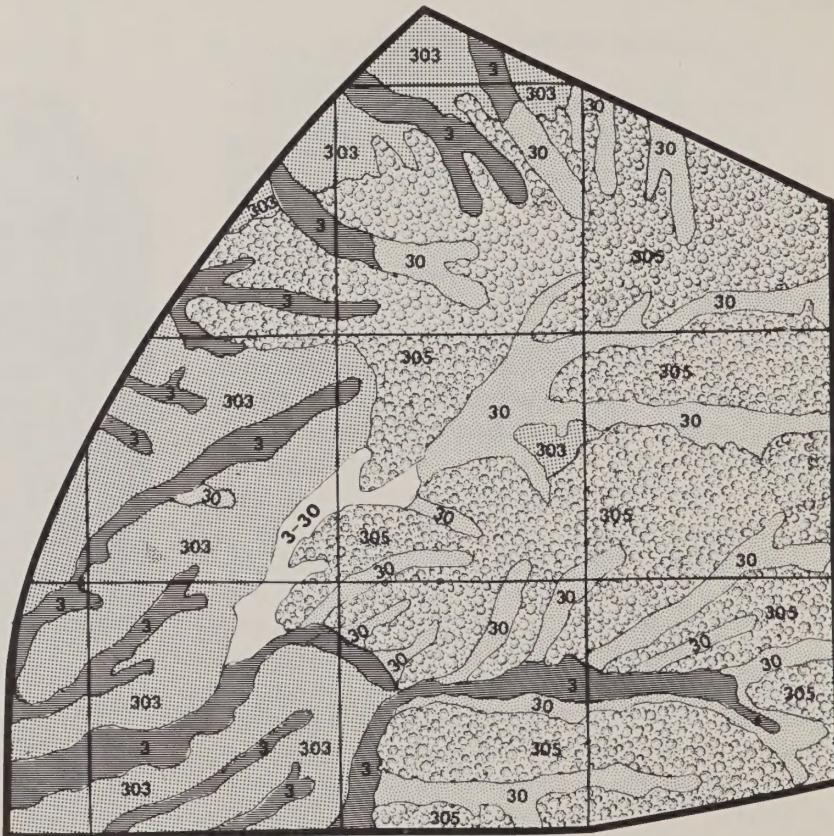
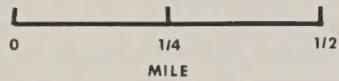


Figure 2.--Aerial view of the Tonto Springs range showing the rolling topography of the granitic outwash. Light blocks have been root plowed and seeded.

Figure 3.--Soils map of the Tonto Springs range.

- 3 Deep, fine gravelly; fine textured alluvial soils
- 30 Moderate to deep; fine gravelly; medium to coarse textured alluvial soils
- 3-30 A complex of units 3 and 30
- 303 Moderately deep; fine gravelly; fine textured lowland residual soils
- 305 Moderately shallow; fine gravelly; fine textured upland residual soils



## Vegetation

Although several shrubs are found at Tonto Springs, only five are frequent enough to be of importance. These are shrub live oak, hairy cercocarpus (mountainmahogany), desert ceanothus, skunkbush sumac, and wait-a-bit. Shrub live oak, by far the most prevalent, makes up about 80 percent of the total shrub crown cover.

Half-shrubs, primarily broom snakeweed, and Wright's buckwheat are present throughout the area and frequently dense. Texas beargrass is found in considerable abundance on lower slopes.

Many grasses are found with the shrubs. The more common ones include blue, black, hairy, and sideoats grama, several threeawns, bottlebrush squirreltail, and longtongue mutton bluegrass.

Although many forbs are present in the area, they seldom contribute much quantitatively to the vegetation. They may, however, become quite numerous and important after soil disturbance.

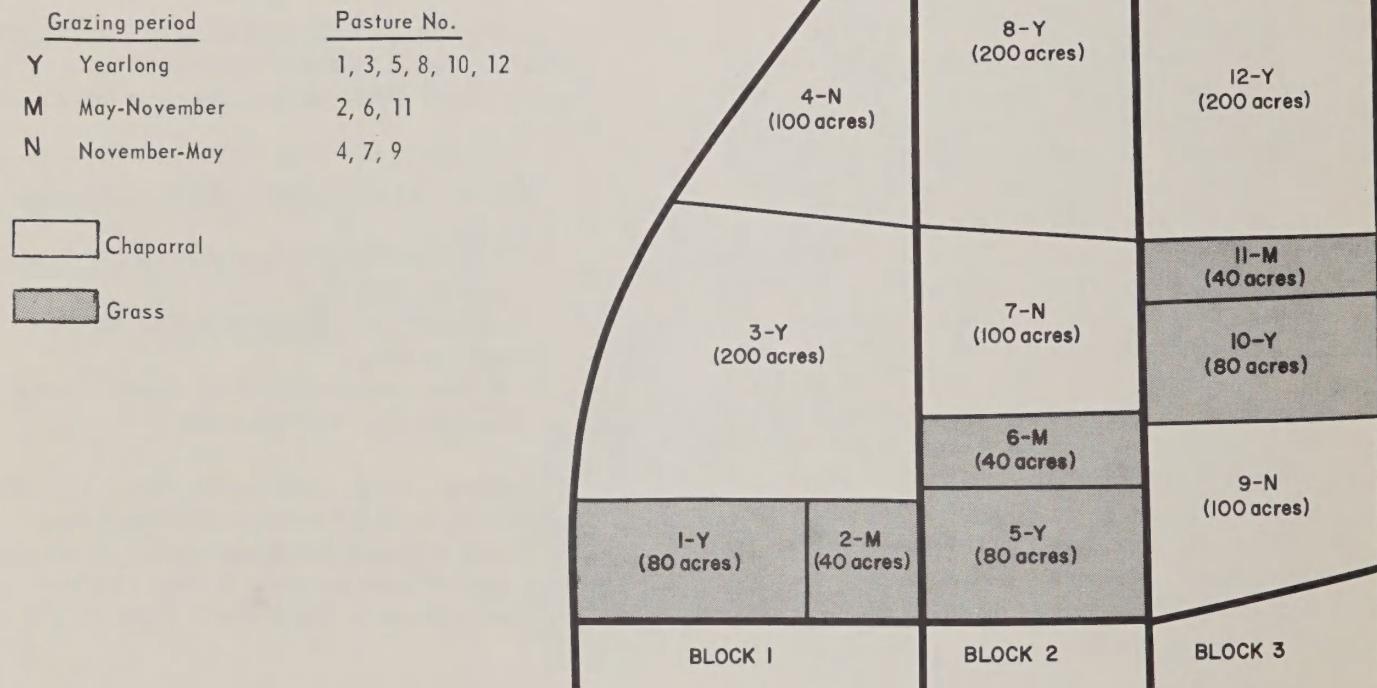
## Experimental Design

An area of 1,260 acres was divided into three blocks containing four experimental pastures each (fig. 4). Each block contains one each of the following:

1. A 200-acre native chaparral pasture grazed yearlong.
2. A 100-acre native chaparral pasture grazed from November 4 to May 4.
3. An 80-acre root-plowed and seeded pasture grazed yearlong.
4. A 40-acre root-plowed and seeded pasture grazed from May 4 to November 4.

Chaparral areas were converted to grass by root plowing to kill the shrubs, and seeding weeping and Lehmann lovegrasses at the rate of three-fourths pound seed of each per acre. A large crawler tractor pulled a blade 10 feet wide at a depth of 8 to

Figure 4.--Pasture location map of the Tonto Springs range.



15 inches to kill the shrubs (fig. 5). Seed was scattered with an electrically operated cyclone-type seeder mounted on the rear of the tractor. The plow effectively eliminated all aboveground vegetation, and completely killed about 80 percent of the

shrubs. Shrubs that have since sprouted were not completely severed by the plow. Most are shrub live oak, with a few scattered plants of skunkbush sumac and wait-a-bit. The treatment was completed in early July 1961.



Figure 5.--At Tonto Springs, a tractor and blade were used to root plow the chaparral.

Fair stands of both seeded grasses developed during the summer of 1961, but by summer of 1962 few plants of Lehmann lovegrass were found. Evidently the area is near the upper limit for this species. The weeping lovegrass stand has continued to improve (figs. 6, 7).



Figure 6.--A chaparral area in pasture 1 before root plowing in 1961.

Corrals, fences, water well, water distribution system, water tanks, and roads were completed between 1961 and 1964 (fig. 8). Also during this pregrazing period, an effort was made to eliminate the remaining shrubs so comparisons could be strictly between grass and chaparral range. Living shrubs



Figure 7.--Same area in pasture 1, in 1964. Weeping lovegrass production was nearly 800 pounds per acre, with less than 50 pounds per acre of Lehmann lovegrass.

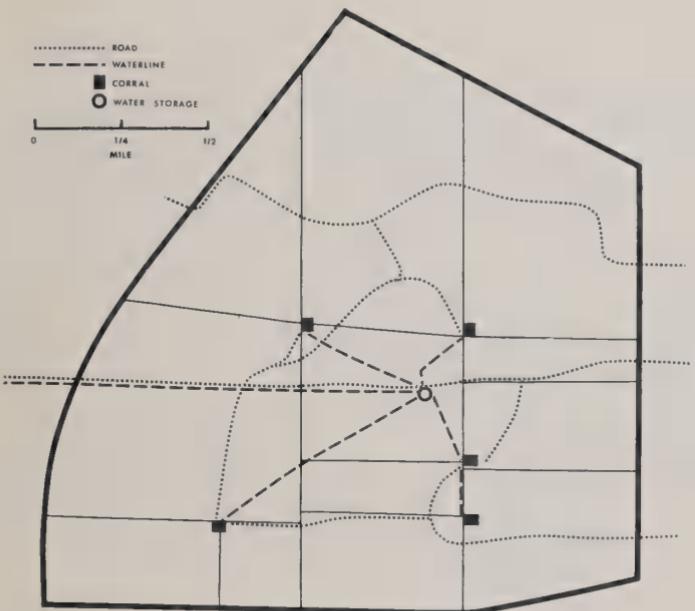


Figure 8.--Road, waterline, water storage, and corral locations on the Tonto Springs range.

on the root-plowed pastures were treated by individual shrub applications of fenuron in 1963. Unfortunately, application rates were low (about 4 pounds per acre) and pellets were applied in June in anticipation of summer rainfall, which was late and inadequate. Low kills were the result. Subsequent applications at rates of 12 pounds per acre applied in December have produced good results.

### Grazing

Animals are grazed yearlong at Tonto Springs. The animals are turned on as calves, at about 300 pounds, in November and remain until the following November. Pasture size was originally chosen to insure the possibility of grazing at least three yearling cattle for the allotted time. However, use of "tester" and "grazer" animals was anticipated to reach the desired utilization goal. The tester animals were carefully weighed to provide the measures of animal responses, and the grazers were added to apply the grazing treatments.

From the beginning it was obvious that three animals would be insufficient to properly utilize

either the grassland or brush range. Forty percent average herbage removal has been the goal for proper use on the seeded grass, while at least 10 percent removal of average yearly growth on shrub live oak has been the utilization goal on brush pastures. To approach these goals, cows and calves were added as grazers in 1965 and part of 1966, but this proved disruptive to the permittee's breeding and calving program. In May 1966, 10 calves were placed on each pasture. In early 1967, additional calves were placed on root-plowed and seeded pastures. In November of 1967, 15 calves were placed on each chaparral pasture grazed yearlong and on each mixed-season pasture and 20 were placed on root-plowed pastures grazed yearlong. How closely these numbers approach desired stocking must await further investigation.

Cattle are weighed at monthly intervals. At first a portable livestock scale was used, but it was replaced by fully automatic weighing devices in early 1968 (fig. 9). The automatic scales consist of a platform supported on four transducers, which transmit appropriate impulses to a battery-operated recorder each time an animal crosses the platform.



Figure 9--

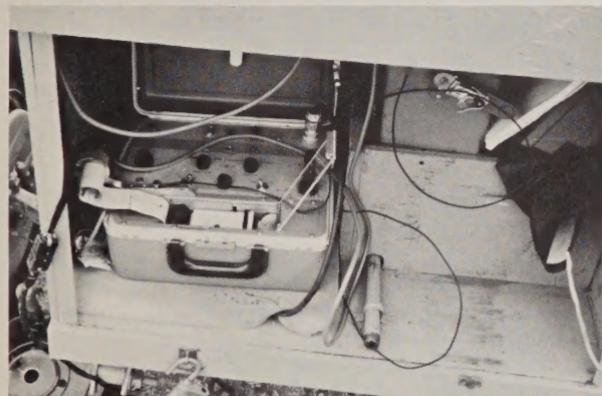
Recording device.

- A. Camera used for animal identification,
- B. Electric eye to turn on scale and camera as animal crosses platform,
- C. Wires going to transducers under corner of platform,
- D. Trailer containing recorder and batteries,
- E. 50-pound weights for calibration of scale.

The recorder and a camera used for identification are turned on when the animal breaks the beam of an electric eye directed across the platform. Animals are identified by a freeze-branded number on the loin.

### Forage

Forty permanent grass and forb sampling points are located in each of the 40-acre root-plowed and



seeded pastures and 60 permanent points are located in each of the other pastures. Utilization and production are estimated by a paired-plot technique. A 9.6 square foot plot is placed 10 feet from each permanent point on a predetermined compass bearing. The compass bearing is changed each year. A second plot, with matching vegetation, is located in the near vicinity.

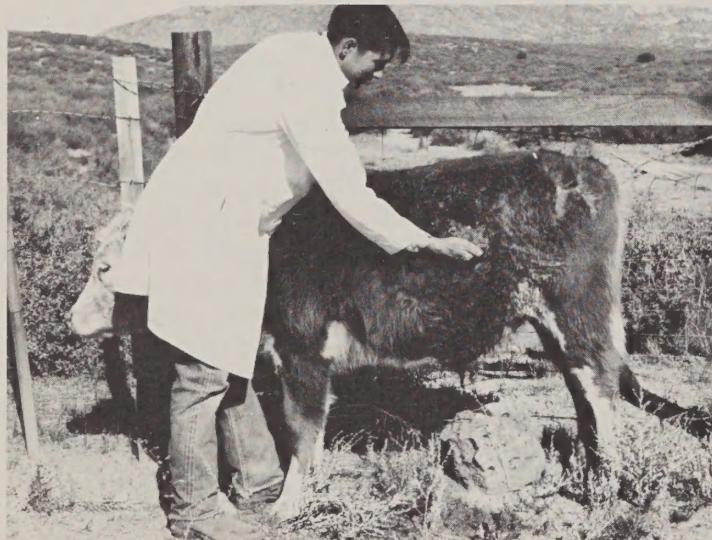
One of the pair, chosen at random, is caged. Utilization is estimated by clipping the vegetation of the caged plot to match the grazed stubble on the uncaged plot (fig. 10). Production is estimated by clipping the remaining stubble of the caged plot to ground level on the last visit of the year and adding this weight to previous utilization weight measurements. Utilization is estimated three times each year on yearlong grazed pastures and two times each year on seasonally grazed pastures.

Forty shrubs (10 of each of the 4 major species) are checked in each of the 6 chaparral pastures. Ten twigs have been tagged on each bush, and growth and use (twigs and leaves) are measured on each tagged twig in March of each year.



Figure 10.--Clipping the caged plot of a pair at Tonto Springs.

Digestibility of the major shrub species and many of the grasses is determined by artificial rumen (*in vitro*) techniques.<sup>3</sup> The technique simulates natural digestion by fermenting small amounts of forage with rumen microorganisms in a buffered nutrient medium under controlled conditions of anaerobiosis, temperature, and pH. Steers with rumen fistulas grazing the vegetation being studied are used to supply the microorganisms (fig. 11).



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<sup>3</sup>Pearson, Henry A. Cattle diet digestibilities determined from components. *J. Range Manage.* 20: 405-406, illus. 1967.

Figure 11.--Rumen fluid for artificial rumen digestion trials is obtained from fistulated cattle.

### Common and Botanical Names of Plants Mentioned

Grama, sideoats	Beargrass, Texas
<i>Bouteloua curtipendula</i> (Michx.) Torr.	<i>Nolina texana</i> S. Wats.
Lovegrass, Lehmann	Bluegrass, longtongue mutton
<i>Eragrostis lehmanniana</i> Nees	<i>Poa longiligula</i> Scribn. & Williams
Lovegrass, weeping	Buckwheat, Wright's
<i>Eragrostis curvula</i> (Schrad.) Nees	<i>Eriogonum wrightii</i> Torr.
Oak, shrub live	Ceanothus, desert
<i>Quercus turbinella</i> Greene	<i>Ceanothus greggii</i> A. Gray
Snakeweed, broom	Cercocarpus, hairy
<i>Gutierrezia sarothrae</i> (Pursh) Britt. & Rusby	<i>Cercocarpus breviflorus</i> A. Gray
Squirreltail, bottlebrush	Grama, black
<i>Sitanion hystrix</i> (Nutt.) J. G. Smith	<i>Bouteloua eriopoda</i> Torr.
Sumac, skunkbush	Grama, blue
<i>Rhus trilobata</i> Nutt.	<i>Bouteloua gracilis</i> (H.B.K.) Lag.
Threeawns	Grama, hairy
<i>Aristida</i> spp. L.	<i>Bouteloua hirsuta</i> Lag.
Wait-a-bit	
<i>Mimosa biuncifera</i> Benth.	

CAUTION: If you use herbicides, apply them only when needed and handle them with care. Follow the directions and heed all precautions on the container label. If herbicides are not handled or applied properly, or if unused portions are disposed of improperly, they may be injurious to humans, domestic animals, desirable plants, honeybees and other pollinating insects, fish or wildlife, and may contaminate water supplies.

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- Participating with all State forestry agencies in cooperative programs to protect, improve, and wisely use our Country's 395 million acres of State, local, and private forest lands.
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